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FLORIDA MEALYBUGS OF THE GENUS RHIZOECUS
WITH DESCRIPTION OF A NEW SPECIES
(HOMOPTERA: PSEUDOCOCCIDAE)

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ABSTRACT—*Rhizoecus floridanus*, a new hypogeic mealybug from Florida and Georgia is described and illustrated. Two taxa, *Morrisonella spinipes* Hambleton and *Ripersiella simplex* Hambleton are assigned to *Rhizoecus*. *Ripersiella simplex*, described originally from Brazil, is reported for the first time from the United States. A key to 8 Florida species is presented with data on host plants and distribution.

This paper provides a name for an undescribed mealybug, presents a key to the Florida species of *Rhizoecus* and includes notes on their identity, host plants and distribution.

The genus *Rhizoecus* is 1 of 9 genera now recognized in the tribe Rhizoecini, as defined by Williams (1969). Of the 9, most of which

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are tropical or subtropical in origin, only members of *Rhizoecus* and one species of *Geococcus* are known to occur in Florida. While engaged in a revision of the genus *Rhizoecus* for the New World, it has been my privilege to study all of the slide-mounted specimens of the genus represented in the Florida State Collection of Arthropods at Gainesville.

In recent years several species of these subterranean mealybugs have become of increasing importance in the production of commercially grown ornamentals and other perennial plants. Prior to 1959, however, there were no records of their occurrence in the State. Subsequently, many specimens have been collected by personnel of the Division of Plant Industry, Florida Department of Agriculture, particularly in nurseries. This intensive collecting has made it possible to record certain facts relative to the identification, presence, and distribution of several species heretofore not known to occur in Florida.

Rhizoecus Künckel d'Herculis, 1878:163; Hambleton, 1946:50; Ferris, 1953:426; McKenzie, 1967:370; Williams, 1962:41.

Type species: *Rhizoecus falcifer* Künckel d'Herculis.

The genus is characterized as follows: Antennae 5- or 6-segmented, geniculate, sensory setae of terminal segments well developed. Anal ring usually distinct, bearing 6 setae, its cellular structure diversiform. Anal lobes usually undeveloped, with or without some degree of sclerotization and bearing 3 or more elongate setae. Derm with either bitubular or tritubular ceroses of 1 or more sizes, trilocular pores, with or without multilocular disk pores and tubular ducts. Circuli number 0-5, their size and shape varying from circular and depressed to conical or truncate. Head often with an irregularly-shaped sclerotized ventral cephalic plate anterior to mouth parts. Eyes small or absent. Legs generally spinose, claws long, ungual digitules short and setose or elongate and often swollen apically. Body setae varying in length, mostly minute. Dorsal ostioles usually distinct, often strongly sclerotized.

KEY TO THE FLORIDA SPECIES OF *Rhizoecus*

1. Abdomen with a circulus; derm without multilocular disk pores _____ 2
 Abdomen without a circulus; derm with multilocular disk pores _____ 5
2. Eyes absent; anal lobes weakly sclerotized _____ *floridanus*, n. sp.
 Eyes present; anal lobes not sclerotized _____ 3
3. Body small, maximum length about 1.40 mm; rostrum moderately short, about 50 μ long; outer portion of anal ring containing 17-23 cells; antennae rather short, sensory setae weakly clavate _____ *simplex* (Hambleton)
 Body large, minimum length about 1.20 mm; rostrum stout, 84-88 μ long; outer portion of anal ring containing 32-40 cells; antennae rather long, sensory setae not clavate, weakly tapered _____ 4
4. Ungual digitules about 1/2 as long as claws, the latter narrow, elongate, about 40 μ long; cells of outer portion of anal ring small, mostly elongate oval or irregularly polygonal _____ *maritimus* (Cockerell)

- Ungual digitules longer than claws, the latter stout, curved, about 20 μ long; cells of outer portion of anal ring rather large, mostly subtriangular and quadrate *cacticans* (Hambleton)
5. Antennae 5-segmented; eyes absent; anal lobes roundly protruding, each bearing 5-7 elongate setae *falcifer* Künckel d'Herculis
- Antennae 6-segmented; eyes present; anal lobes simple or only weakly protruding, each bearing less than 5 elongate setae 6
6. Anal ring setae short, stout, about 35 μ long; tritubular cereres large, of 1 size only; multilocular disk pores mostly with 7 loculi
..... *spinipes* (Hambleton)
- Anal ring setae more elongate, 70-90 μ long; tritubular cereres of 2 or 3 sizes; multilocular disk pores mostly with 10 loculi 7
7. Anal lobes not sclerotized; eyes very small, usually weakly pigmented; multilocular disk pores relatively sparse, occurring only ventrally near vulva; tritubular cereres of 2 sizes; cephalic plate apparently absent
..... *pritchardi* McKenzie
- Anal lobes usually sclerotized; eyes much larger, strongly pigmented; multilocular disk pores more numerous, occurring dorsally and ventrally over entire derm; tritubular cereres of 3 sizes; cephalic plate present
..... *americanus* (Hambleton)

Rhizoecus americanus (Hambleton)

Morrisonella americana Hambleton, 1946:18, fig. 18-19c.

Rhizoecus americanus: Ferris, 1953:428, fig. 163.

The first authentic record for the occurrence of this species in continental United States was made in Florida in August, 1959 from specimens collected on the roots of *Dieffenbachia* sp. by C. O. Youtsey at Altamonte Springs. *Rhizoecus americanus* was originally described from Columbia, Ecuador, Cuba, Jamaica, and the British West Indies from the roots of grasses, coffee, and palm. In recent years this mealybug has been collected on some 30 different host plants, representing at least 17 plant families from Gainesville in the north to Sugarloaf Key, near Key West in the south. Its occurrence on local grasses and its wide distribution lend support to the belief that the species may be endemic to the State.

Unless otherwise indicated, the names of collectors and collecting dates for the taxa *americanus* and *simplex* are omitted to conserve space. The majority of records were made during 1970 to 1971.

Host records: On *Aralia* sp., Largo; *Areca* sp., Seminole; *Arcestrum romanzoffianum*, Largo; *Araucaria excelsa*, Bradenton, Palmetto, Snead Island, St. Petersburg; *Asparagus sprengeri*, Snead Island; *Calliandra haematocephala*, Osprey; *Calliandra* sp., Largo, Snead Island; *Callistemon viminalis*, Tallevast; *Callistemon* sp., Delray Beach; *Chlorophytum* sp., Largo; *Chrysalidocarpus lutescens*, High Point, Largo; *Dieffenbachia amoena*, Clarcona; *Dieffenbachia picta*, Fern Park, Aug. 1962; *Dieffenbachia* sp., Altamonte Springs, Aug., 1959, Clarcona, Fern Park, Apr., 1965; *Dizygotheca elegantissima*, Largo, Sarasota; *Ernodes* sp., Sugarloaf Key; *Euphorbia milii*, Largo; *Ficus nitida*, Largo; *Gnaphalium* sp., Fern

Park; *Hemigraphis replans*, Clarcona; *Hibiscus rosasinensis*, Largo, Osprey; *Hibiscus* sp., St. Petersburg; *Lantana* sp., Gainesville; *Liriope* sp., Largo; *Malpighia coccigera*, N. Fort Meyers, Orlando; *Nephtytis* sp., Fern Park; *Peperomia pellucida*, Fern Park; *Phoenix loureiri*, Snead Island; *Pothos* sp., Fern Park; *Pyracantha coccinea*, Largo; *Rhaphiolepis* sp., Largo; *Saintpaulia ionantha*; Winter Garden, Aug., 1967; *Strelitzia reginae*, Largo; on Gramineae, Flamingo; in debris of packrat nest, Upper Key Largo, March, 1968.

Rhizoecus americanus may be readily distinguished from all other Florida hypogeic mealybugs by the presence of tritubular ceroses occurring in 3 distinct sizes. Other helpful identification characters are its larger size, the sclerotized anal lobes, and wide distribution of the multilocular disk pores.

Rhizoecus cacticans (Hambleton)

Ripersiella cacticans Hambleton, 1946:64, fig. 57-58.

Rhizoecus cacticans: Ferris, 1953:432, fig. 165; McKenzie, 1960:745; McKenzie, 1967:379, fig. 153.

The only known record for *Rhizoecus cacticans* in Florida is based on 2 specimens collected on *Mesembryanthemum* sp. at Sanford, Seminole Co., 15 February 1963, by C. O. Youtsey. Until additional material is discovered, the true status of *cacticans* in Florida will remain questionable. The Sanford specimens were originally recorded (Tri-ology 1963) as *R. leucosomus* (Cockerell), a species not known to occur in Florida. This species and *cacticans* have been confused with *R. simplex* (Hambleton) and the new species *floridanus*, both quite common in the State.

R. cacticans is a comparatively large mealybug with a long rostrum, unsclerotized anal lobes, and with its anal ring composed of 32-40 rather large subtriangulate or quadrate cells in its outer portion. Other distinguishing differences are presented in the key (p. 64).

Rhizoecus falcifer Künckel d'Heroulais

Rhizoecus falcifer Künckel d'Heroulais, 1878:163; Hambleton, 1946:53, fig. 41-43; Ferris, 1953:444, fig. 172; Williams, 1962:47; McKenzie, 1967:389, fig. 158.

Rhizoecus falcifer has not been collected in Florida. Its inclusion here is based upon 4 specimens in the United States National Museum (USNM) collected by W. S. Craig in Iowa, 20 November 1953, from roots of palm shipped from Florida. At the present time *falcifer* is known to occur in Missouri, New Jersey, New York, and California. According to McKenzie (1967) this mealybug is one of the more common species in California, occurring there on a wide variety of host plants.

The important characters separating *falcifer* from related species are its large size, 5-segmented antennae, absence of eyes, and number of elongate anal lobe setae.

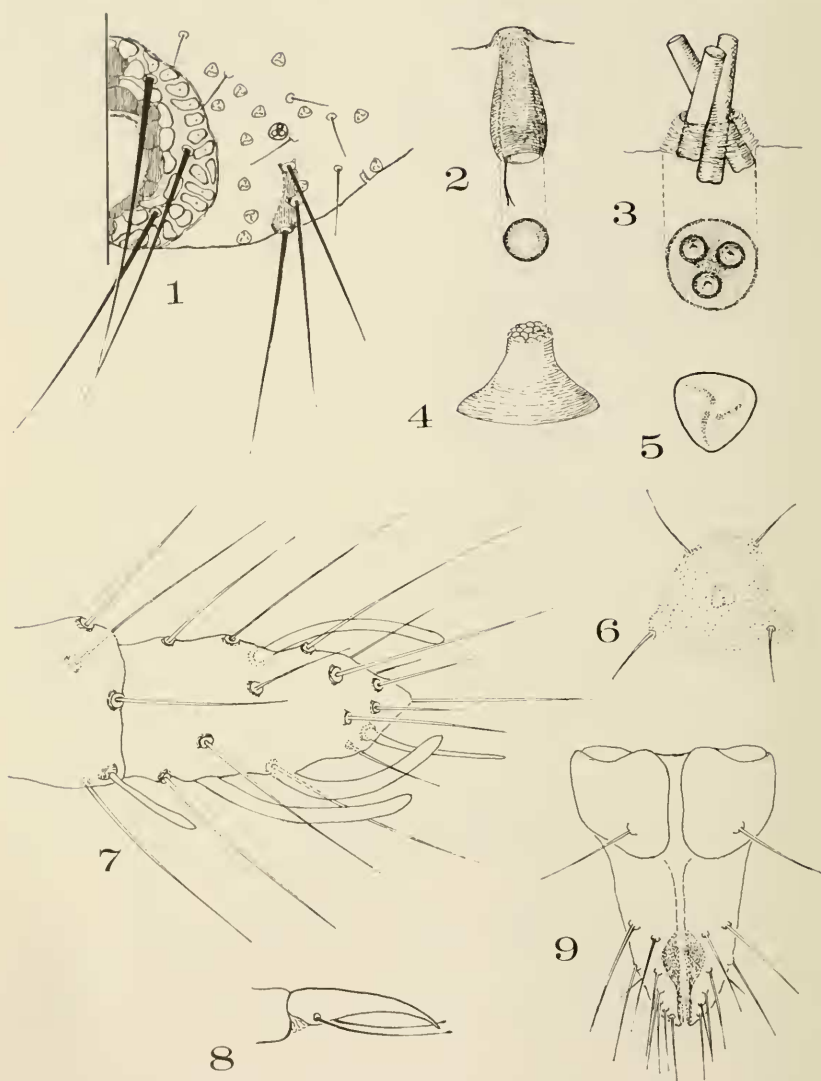


Fig. 1-9, *Rhizococcus floridanus*, n. sp., ♀: apex of abdomen, right half, showing anal ring and anal lobe characters; 2, tubular duct; 3, tritubular ceror; 4, circulus, lateral view; 5, trilocular pore; 6, cephalic plate; 7, 5th and 6th antennal segments showing falcate sensory setae; 8, claw; 9, rostrum.

Rhizococcus floridanus, n. sp.

fig. 1-9

Adult female: Rather broadly ovate, more acute in area of head and thorax. Length, 1.20-1.63 mm; width, 0.65-0.80 mm. Antennae 6-segmented, of medium size, average length of segments in microns as follows: I, 31; II, 19; III, 25; IV, 17; V, 16; VI, 37; apical segment slightly less than twice as long as wide, bearing 3 moderately long, stout falcate setae and 1 slender, acute sensory seta; penultimate segment with 1 smaller, rather elongate, weakly clavate sensory seta. Interantennal space equal to about twice the length of segment I. Eyes absent. Rostrum relatively short, measuring about 57μ long, 40μ wide; rostral loop extending to or near insertion of 2nd pair of legs. Cephalic plate irregularly triangulate to quadrate, wider posteriorly, about 38μ across its base, bearing indistinct vacuoles. Dorsal ostioles weakly sclerotized, inconspicuous.

Legs of medium size, average length of segments of hind pair measured in microns as follows: trochanter, 37; femur, 81; tibia, 69; tarsus, 51; claw, 22; unguis long, their tips swollen, surpassing claws, the latter narrow, elongate, weakly curved.

Abdomen bearing 1 conical cirrus, variable in size, width at base varying from 21- 35μ , its apex finely foveolate. Anal lobes undeveloped, each with a small, narrow sclerotized patch between the 3 elongate setae, the longest measuring about 60μ long. Anal ring about 60μ in diameter, its 6 setae considerably longer and stouter than lobe setae, averaging about 87μ long; outer anal ring cells large, diversiform, 24-33 present, mostly isolated; inner portion of anal ring with 14-20 cells of similar size and shape lying adjacent to an inner darkened area of semi-circular cells. Tritubular cerata small, walls of their individual ducts almost parallel, 36-40 present dorsally and ventrally, most abundant on abdomen and rather evenly distributed elsewhere. Multilocular disk pores absent. Tubular ducts small, occurring on both surfaces widely scattered but absent on dorsum of head. Trilocular pores fairly evenly distributed. Body setae mostly short.

Holotype female: Florida: Pembroke, Broward Co., 2-VIII-67, R. G. Schmidt, on roots of *Dracaena marginata*, in USNM.

Paratypes: FLORIDA. 133 adult females from *Aechmea orlandiana*, Lockhart, 6-I-64, R. J. Griffith; *Anthemis* sp., Tall Timbers, 12-XII-69, H. H. Tippins; *Aralia* sp., Clearwater, 12-II-71, E. W. Miller; *Arecastrum romanzoffianum*, Osprey, 10-II-71, J. R. McFarlin; *Araucaria excelsa*, Arcadia, 26-II-71, G. P. Lamb; *Bambusa* sp., Orlando, 20-X-69, F. L. Ware; *Billbergia* sp., 30-XII-63, R. J. Griffith; *Buxus carissa*, Eau Gallie, 8-II-71, H. C. Levan; *Buxus* sp., Mango, 19-II-71, E. R. Simmons, Plant City, 19-II-71, D. A. Vaughn; *Calliandra* sp., Largo, 10-II-71, C. K. Hickman et al.; *Callistemon rigidus*, Lakeland, 6-VI-69, J. W. McLeod; *Callistemon* sp., W. Melbourne, 12-II-71, H. C. Levan; *Carissa grandiflora*, Fairville, 2-II-71, F. L. Ware, Largo, 10-II-71, C. K. Hickman, Naples, 4-III-71, W. T. Walsh, Orlando, 21-V-71, F. L. Ware, Sarasota, 22-II-71, J. R. McFarlin, Tampa, 15-II, 2-III-71, C. W. Hale; *Carissa* sp., Fairville, 22-II-71, F. L. Ware, Punta Gorda, 16-V-71, G. B. Lamb, Seffner, 12-II-71, D. A. Vaughn, W. Palm Beach, 11-II, 4-III-71, H. L. Messec; *Citrus mitis*, Largo, 10-II-71, C. K. Hickman; *Cortaderia selleana*, Largo, 11-II-71, G. T. Williams; *Dizygotheca elegantissima*, Bradenton, 5-I-71, J. R. McFarlin, Delray Beach, 15-II-71, W. E.

Wyles, Grant, 19-II-71, H. C. Levan, Osprey, 5-II-71, J. R. McFarlin; *Eremochloa ophiuroides*, Gainesville, 29-III, 19-IV-67, G. W. Dekle and C. Lyons; *Eugenia* sp., Palmetto, 25-II-71, J. R. McFarlin; *Gardenia thunbergia*, Pembroke, 14-IV-67, H. C. Schmidt; *Iloya* sp., Orlando, 10-II-71, E. R. Fatic; *Ilex opaca*, Oneca, 27-V-71, J. R. McFarlin; *Ilex rotunda*, Fairvilla, 2-II-71, F. L. Ware; *Ilex vomitoria*, Englewood, 29-IV-71, C. J. Bickner; *Ilex* sp., Seffner, 17-VIII-71, D. A. Vaughn; *Ilex cornuta burfordi*, Fairvilla, 21-XII-71, F. L. Ware; *Ixora* sp., Sebastian Inlet, 12-II-71, H. C. Levan; *Jasminum* sp., Gillette, 23-V-71, C. J. Bickner; *Lachnanthes tinctoria*, Casselberry, 26-XII-63, C. O. Youtsey; *Leucophyllum frutescens*, Winter Haven, 11-VII-68, H. C. Burnett; *Philodendron selloum*, Apopka, 11-II, 15-II-71, C. L. Speaker, Plymouth, 29-I, W. W. Smith and E. R. Fatic, 19-V-71, H. M. Van Pelt; *Pyraecantha* sp., Mango, 19-II-71, E. R. Simmons; *Rhododendron* sp., Bradenton, 11-I-71, S. L. Poe, Largo, 11-II-71, G. T. Williams; *Viburnum suspensum*, Osprey, 15-II-71, J. R. McFarlin; Bromeliaceae, Orlando, 26-II-71, D. A. Grady; palm, Pinellas Park, 18-II-71, C. K. Hickman; Gramineae, Plymouth, 12-X-71, H. M. Van Pelt. GEORGIA. 4 adult female paratypes, Spaulding Co., on perennial grasses, 16-V-1968, H. H. Tippins.

All paratypes are in the Florida State Collection of Arthropods, Gainesville, with the exception of 2 each to be deposited in the collections of the University of California, Davis; Virginia Polytechnic Institute, Blacksburg; University of Georgia, Experiment; British Museum (Natural History), London, and 5 in the USNM.

This mealybug should not be mistaken for any of its Florida relatives. Its closest ally is probably *R. simplex*, but this species has eyes and unsclerotized anal lobes, characters that separate it at once from *floridanus*. The cellular structure of the outer portion of the anal ring of the former is also of smaller size, the cells being more oval elongate than those of *floridanus*.

Rhizococcus maritimus (Cockerell)

Ripersia maritima Cockerell, 1894:42.

Ripersiella maritima: Cockerell, 1899:278.

Morrisonella maritima: Hambleton, 1946:31, fig. 14-17.

Rhizococcus maritimus: Ferris, 1953:452, fig. 176.

This maritime species has not previously been reported from the State of Florida. Known heretofore only from the coastal area of the northeastern States, *R. maritimus* may be restricted in its host preference to those salt-tolerant plants inhabiting coastal waterways.

Host records: On *Faucaria tigrina*, Tampa, 17-II-71, E. R. Simmons; *Rhizophora mangle*, Bailey's Bluff, 7-III, 3-VIII-71, G. T. Williams; *Spartina patens*, Cedar Key, 19-VII-70, G. W. Dekle.

The distinguishing characters of *R. maritimus* are its large, stout rostrum, small tritubular cereres, long, slender claws, and small cells of the outer portion of the anal ring.

Rhizoecus pritchardi McKenzie

Rhizoecus pritchardi McKenzie, 1960:749, fig. 23; McKenzie, 1967:400, fig. 162.

Since this species was first described by McKenzie (1960) from California, *R. pritchardi* has been taken in 6 additional States, including Florida in 1966. African Violet appears to be a preferred host, and it has undoubtedly been widely distributed on this plant in commerce across the United States.

Host records: On *Saintpaulia ionantha*, Apopka, 1-IV, 11-V-71, R. M. Remington, Gainesville, 23-V-68, E. Mercer, Largo, 22-IV-66, J. R. McFarlin.

No other Florida species of *Rhizoecus* is easily confused with *R. pritchardi*. Some specimens measure more than 2 mm in length, and the antennae are widely separated. The derm bears tritubular cereres of 2 sizes but lacks tubular ducts of the usual type.

Ripersiella simplex Hambleton, 1946:73, fig. 77-77a.

Rhizoecus simplex (Hambleton), n. comb.

This little mealybug is here recorded for the first time in the Northern Hemisphere. Previously it was known only from the type locality, São Paulo, Brazil. Material first collected in Gotha, Fla. in August, 1961 was misidentified as *R. cacticans* and reported (Tri-ology 1963) as a new state record. Also, 5 specimens from Bellingham, Washington, September, 1965, were incorrectly identified and noted (CEIR 1969) as new for the State. Two specimens before me from Berkeley, California labeled *cacticans* agree with the type of *simplex*.

R. simplex is now distributed in at least 10 counties in Florida and is commonly encountered in nursery stock.

Host records: On *Buxus carissa*, Eau Gallie; *Calendula* sp., Gainesville; *Carissa grandiflora*, Orlando, Tallevast; *Coccoloba uvifera*, Fairville; *Cordylone* sp., Lockhart; *Cryptanthus* sp., Winter Garden; *Dieffenbachia* sp., Lockhart; *Dizygotheca elegantissima*, Bradenton; *Eriobotrya japonica*, Pompano Beach, Oct., 1963; *Euphorbia milii*, Fairville; *Gardenia* sp., W. Melbourne; *Hedera helix*, Fairville; *Hoya carnosa*, Apopka, Lockhart, Winter Garden, Jan., 1965; *Hoya exotica*, Winter Garden, Feb., 1968; *Ixora coccinea*, Osprey; *Ixora* sp., Sebastian Inlet; *Neoregelia* sp., Gotha, Jan., 1961; *Nephrolepis exaltata*, Lockhart; *Peperomia* sp., Lockhart; *Pilea microphylla*, Lockhart; *Strelitzia reginae*, Homestead, Snead Island; *Zygocactus truncatus*, Leesburg, Oxford; *Zygocactus* sp., Palma Sola, Dec., 1967; in packrat nest debris, Upper Key Largo, March, 1968.

This subterranean species bears no resemblance to *R. cacticans*, with which it has previously been confused. *Rhizoecus simplex* is 1 of the smallest mealybugs. Of the Florida species, it more closely resembles *floridanus*. Their differences, however, are readily observed and are indicated in the key.

Rhizococcus spinipes (Hambleton), n. comb.

Morrisonella spinipes Hambleton, 1946:36, fig. 22-24.

To date, only 1 collection of this rather unique mealybug has been made in Florida, but its occurrence in the State comes as no surprise since it was originally described from Arkansas. Study of the 8 Florida specimens as well as a single female from Mexico confirms the validity of *R. spinipes*. Unfortunately this species was omitted from Ferris' Atlas of the Pseudococcidae (1953), and from the more recently published keys to the North American species of *Rhizococcus* by McKenzie (1960, 61, 62, 67).

Host record: *Andropogon rhizomatus*, Gainesville, 10-X-67, K. R. Langdon.

The broadly ovate body, small appendages, large tritubular ceroses, and short, stout anal ring setae separate *spinipes* from any other described member of the *Rhizococcus*.

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MITES ASSOCIATED WITH AQUATIC AND SEMI-AQUATIC DIPTERA FROM SAN MATEO COUNTY, CALIFORNIA

(ACARINA: HYGROBATIDAE, UNIONICOLIDAE, PIONIDAE, ASCIDAE AND DIPTERA:
CHIRONOMIDAE, TIPULIDAE, PSYCHODIDAE)

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ABSTRACT—Light trap collections near a reservoir in San Mateo County, California, included many aquatic and semi-aquatic Diptera (Chironomidae, Tipulidae, Psychodidae) with attached mites (Acarina: Hygrobatidae, Unionicolidae, Pionidae, Ascidae). Insects and associated mites are listed along with abundance and some observations on their biology. Weekly tabulation of mite incidence on *Phaenopsectra profusa* (Townes) is presented.

We have been concerned with an assessment of the chironomid fauna occupying the Crystal Springs Reservoir, San Mateo County, California. Early in this study a number of Diptera were observed in a symbiotic relationship with certain Acarina. The purpose of this paper is to report the association of representatives of 4 families of mites and 3 families of Diptera collected during the spring of 1967.

Crystal Springs Reservoir, which occupies a small basin along the San Andreas Fault, has a capacity of 22 billion gallons and an approximate surface area of 1341 acres. The Reservoir, owned by the City and County of San Francisco, is one of their many water-holding areas that extend from the Sierra Nevada Mountains north of Yosemite National Park to the San Francisco Peninsula. These reservoirs supply drinking water to the residents of San Francisco and several neighboring cities on the Peninsula. Recent changes in the water delivery will bypass the Crystal Springs Reservoir and thus transport water directly from the Sierra Nevada Mountains to the consumer. Projected use of this area remains uncertain. Constant encroachment onto land